Army Science & Technology

"America's Army – Decisive Force"

Army S&T Priorities

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Office of the Deputy Assistant Secretary of the Army for Research and Technology

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Purpose

- **Update S&T strategy development**
- **Review the new processes we are implementing in Army S&T**
- **Highlight opportunities for partnership**

What we have learned …

We have learned from last decade of war …

This is What We Learned – It's all about the Soldier and…

"In the past the small unit was built around the fighting system. Today and for the future, the fighting system must be built around the small combat unit."

MG(R) Robert Scales*

*Ground Combat Vehicle CONOPS - Concept paper dated Dec 2, 2010

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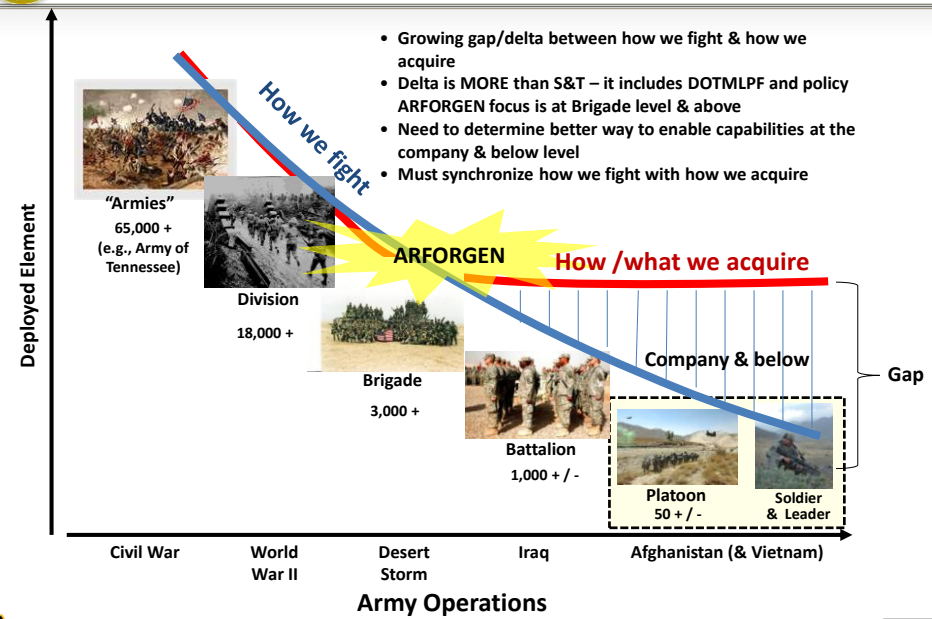
Where should our focus be?

- Growing gap/delta between how we fight & how we acquire
- Delta is MORE than S&T – it includes DOTMLPF and policy ARFORGEN focus is at Brigade level & above
- Need to determine better way to enable capabilities at the company & below level
- Must synchronize how we fight with how we acquire



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We will continue to pursue programs focused on the Soldier and small unit capabilities with the intent of making our formations more flexible, adaptable and lethal.

MAINTAINING A LEADING EDGE IN TECHNOLOGY

What we have done …

Since 2010 we have been making strides to address…

DASA(R&T)'s Problem & Challenge

- **The Problem**
  - **It takes too long to get technology enabled capabilities to the field**
  - **Army S&T is perceived as irrelevant**
- **Fixing the Problem requires:**
  - **New comprehensive strategy**
  - **Changing the culture**
  - **Restoring confidence in Army S&T**
  - **Building a strong Partnership with Leadership**
  - **Motivating the workforce towards results**

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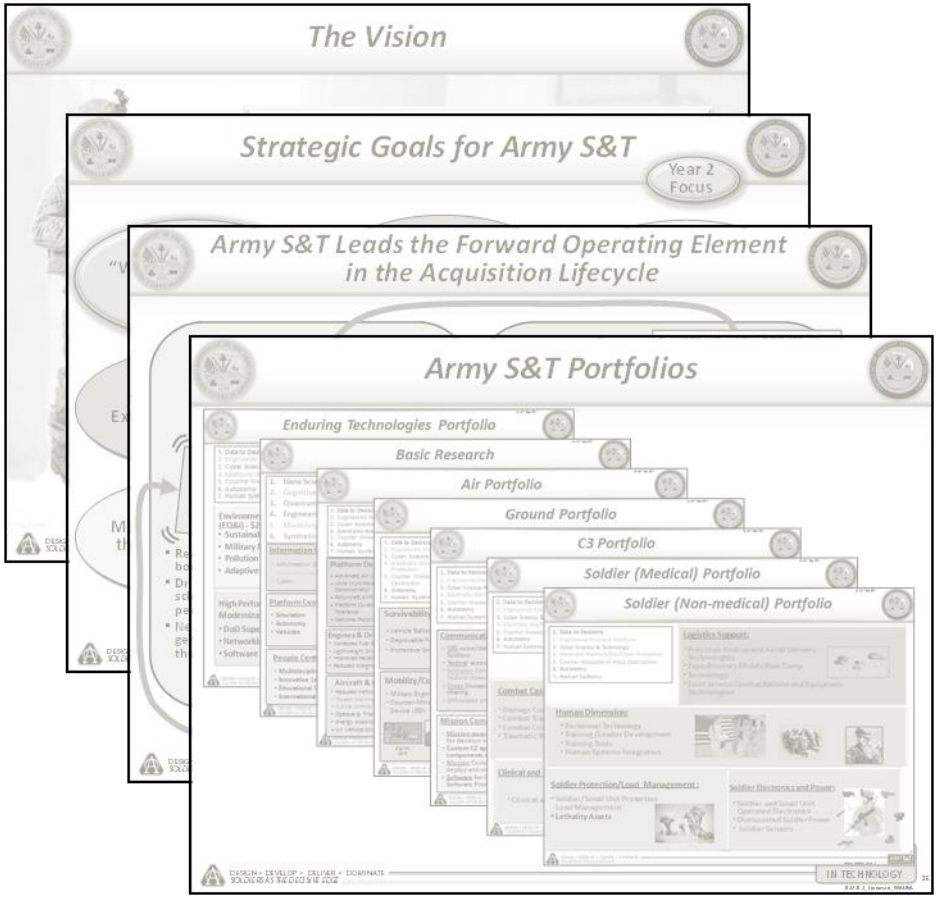
We have validated a new set of priorities for and approaches to managing Army S&T…



MAINTAINING A LEADING EDGE IN TECHNOLOGY

The Vision

Vision

Provide *Technology Enabling Capabilities* that Empower, Unburden and Protect our Soldiers and Warfighters in an environment of Persistent Conflict

Our Challenge

Deliver these technologies through effective partnerships in synchronization with Army Force Generation (ARFORGEN) and fiscal processes

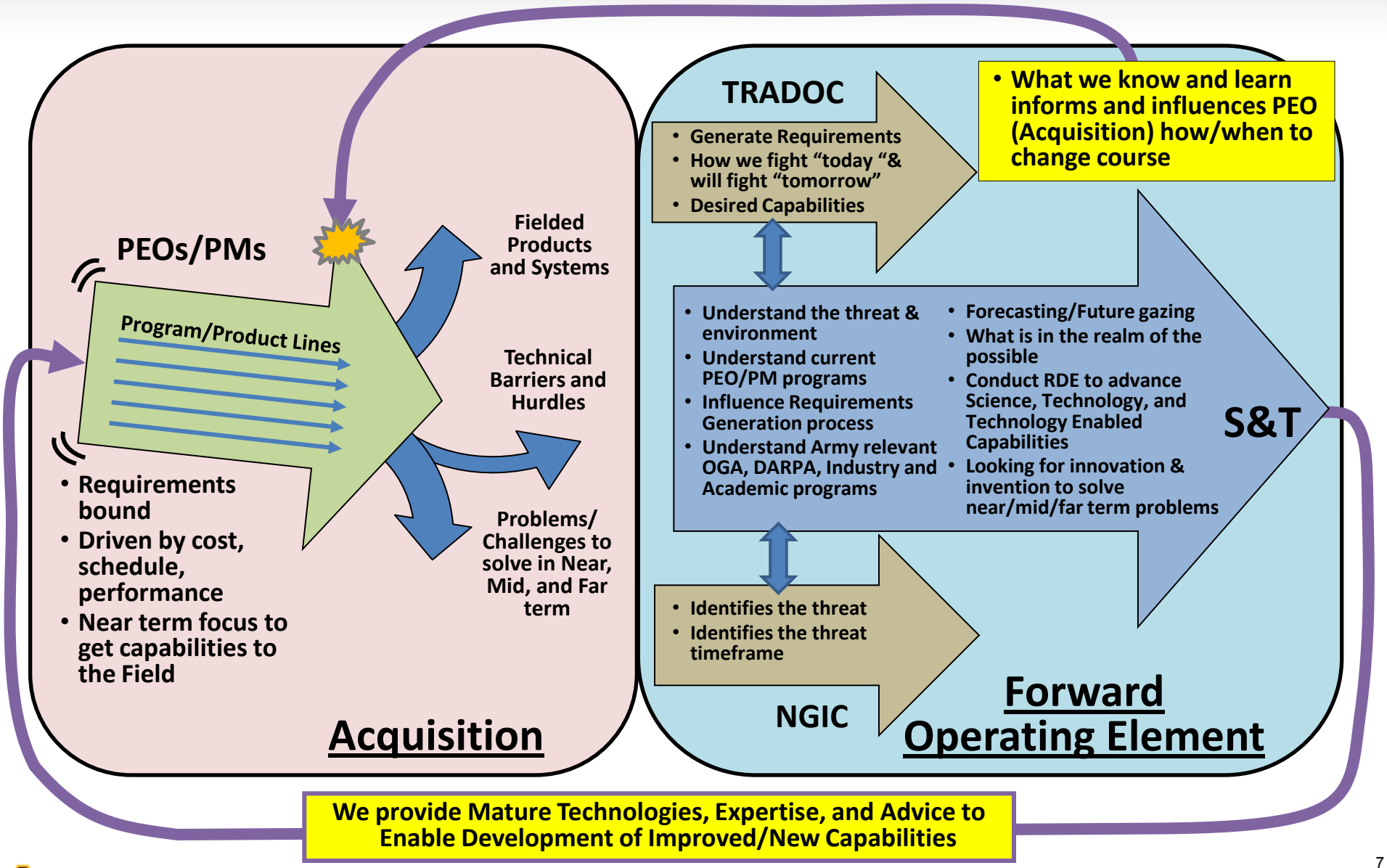
Respond Rapidly to Technological Evolution

Strategic Goals for Army S&T

Year 2 Focus

- "World Class" Science & Technology
- Timely Transition of the Right Technologies
- Recognized Leader in Defense Development and Engineering
- Strong Internal & External Partnerships
- High Quality, Relevant Facilities and Capabilities
- Balanced Investment Portfolio
- Highly Skilled, Motivated Workforce that Exemplifies our Core Values
- Effective, Efficient, & Adaptable Processes
- Government and Public Understanding of Our Value

Army S&T Leads the Forward Operating Element in the Acquisition Lifecycle



We provide Mature Technologies, Expertise, and Advice to Enable Development of Improved/New Capabilities

S&T Portfolios

Enduring Technologies Portfolio

1. Data to Decis
2. Engineered
3. Cyber Scienc
4. Electronic W
5. Counter We
6. Autonomy
7. Human Syste

Environmen (EQ&I) - $2
- Sustainab
- Military M
- Pollution
- Adaptive

High Perfor Modernizat
- DoD Supe
- Networkin
- Software

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Basic Research

1. Nano Scie
2. Cognitive
3. Quantum
4. Engineere
5. Modeling
6. Synthetic

Information C
- Information S
- Network Scie
- Cyber

Platform Cen
- Simulation
- Autonomy
- Vehicles

People Cent
- Multidisciplin
- Innovative La
- Educational C
- International

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Air Portfolio

1. Data to Decisi
2. Engineered R
3. Cyber Science
4. Electronic Wa
5. Counter Weap
6. Autonomy
7. Human Syste

Platform De
- Advanced Air V
- Joint Multi-Role Demonstrator
- Rotorcraft Airf
- Platform Durab Tolerance
- National Rotor

Engines & Dr
- Increased Fuel E
- Lightweight Dri
- Improved Reliab
- Reduced Weight

Aircraft & (
- Reduced Vehic
- Threat Warnin
- Active Jammer
- Opaque & Tra
- Energy Absorb
- Air Vehicle Str

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Ground Portfolio

1. Data to Decision
2. Engineered Res
3. Cyber Science &
4. Electronic Warf Protection
5. Counter Weapo Destruction
6. Autonomy
7. Human Systems

Survivability
- Vehicle Ballisti
- Deployable Fo
- Protective Stru

Mobility/Co
- Military Engine
- Counter-Mine Device (IED)

Digital GPR

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C3 Portfolio

1. Data to Decision
2. Engineered Res
3. Cyber Science &
4. Electronic Warf
5. Counter Weapo
6. Autonomy
7. Human Systems

Communicati
- GIG voice/dat Soldiers
- Tactical access
- Intrusion Dete reduce netwo
- Cross Domain sharing
- Affordable ph

Mission Comm
- Mission-awar for decision m
- Custom C2 ap components a
- Mission Comm deploy and ma
- Software for C Software Prod

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Soldier (Medical) Portfolio

1. Data to Decision
2. Engineered Res
3. Cyber Science &
4. Electronic Warf
5. Counter Weapo
6. Autonomy
7. Human Systems

Combat Cas
- Damage Co
- Combat Tra
- Combat Crit
- Traumatic B

Clinical and
- Clinical a

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Soldier (Non-medical) Portfolio

1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Logistics Support:
- Precision Airdrop and Aerial Delivery Technologies
- Expeditionary Mobile Base Camp
- Technology
- Joint Service Combat Rations and Equipment Technologies

Human Dimension:
- Personnel Technology
- Training /Leader Development
- Training Tools
- Human Systems Integration

Soldier Protection/Load Management:
- Soldier/Small Unit Protection Load Management
- Lethality Assets

Soldier Electronics and Power:
- Soldier and Small Unit Operated Electronics
- Dismounted Soldier Power
- Soldier Sensors

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Experimentation Venues

Technology Enabled Concepts through Warfighter Evaluations

Technology Wargames	Concept Exploration	Technology Concept Demonstrations	Concept Development Experiments	Concept Development Warfighter Evaluations	Field Evaluations (in theater)
	• Technology Enabled Concepts Experiments • Warfighting Concepts Experiments • Technology transduction activities	• Vignette driven alternative technology experiments • Warfighting Concepts Experiments	• TECDS - Technology - Enabled Capability Demonstrations • JCTDs	• Combined/ Network supported technology driven virtual/real combined experiment • Determine potential operational value & TTP options	• Small Unit Experiments • Strength/ deficiency evaluations
• S&T Labs/ Centers	• Army S&T –SILs at Labs/Centers • TRADOC – Unified Quest	• C3 OTM • C4ISR (CSIL) • Radio Lab (REAL) • TRADOC Centers of Excellence	• AEWE • TRADOC Centers of Excellence • NTC	• NIE/CIE • Ft. Bliss • White Sands	

Simulations/MITL

Simulations & Hardware

Requirements Generation

Increasing Maturity

PORs and Supporting Requirements (DOTMLPF)

MAINTAINING A LEADING EDGE IN TECHNOLOGY

S&T Resources: Funding Categories, People, Partnerships 6.1, 6.2, 6.3

Basic Research	Applied Research	Advanced Technology Development
6.1 • Obtain knowledge for an uncertain future—invention and discovery • Understand theories and phenomenology that may impact Army needs	**6.2** • Conduct research and apply knowledge/understanding to specific Army problems and challenges • Conceptualize and experiment with components, subsystems, models—discovery and innovation	**6.3** • Develop and integrate technologies at sub-system and system level • Demonstrate feasibility of technology enabled capabilities • Define transition paths to accelerate introduction of technology enabled capabilities to the Warfighter
People **Theoretical & Experimental Scientists** • Chemists • Physicists • Material scientists • Psychologists • Physiologists • Neuroscientists • Mathematicians • Medical doctors	**People** **Scientists, Technologists, Experimentalists** • Chemists • Physicists • Material scientists • Psychologists • Physiologists • Neuroscientists • Mathematicians • Medical doctors • Nutritionists • Electronics	**People** **Scientists, Engineers, Designers, Fabricators** • Chemical • Civil • Industrial • Aerospace • Structural • Biomedical • Thermodynamicists • Mechanical • Clothing designers • Colorists • Electrical • Psychologists
Partnerships **64% Universities/Industry** **36% In-House**	**Partnerships** **33% Industry** **67% In-House**	**Partnerships** **60% Industry** **40% In-House**

S&T Resources: Funding Categories, People, Partnerships 6.4, 6.6, 6.7

Technology Maturation Initiatives

6.4

- Funds efforts necessary to evaluate integrated technologies that will expedite technology transition to programs of record.
- Funds technology maturation efforts, including competitive prototyping, for selected pre-Milestone B programs of record.

People

Scientists, Engineers, Designers, Fabricators

- Chemical
- Civil
- Industrial
- Aerospace
- Structural
- Biomedical
- Thermodynamicists
- Mechanical
- Clothing designers
- Colorists
- Electrical
- Psychologists

Partnerships

90% Universities/Industry
10% In-House

Technical Information Activities

6.6

- Supports upgrading the accuracy, timeliness, availability, and accessibility of scientific, technical, and management information at all levels of the Army R&D community.
- Management of this accurate and timely technical information is essential for enabling Army Science and Technology (S&T) leadership to refine investment strategy and quickly react to emerging opportunities and issues.

People

S&T Management and Technical Analysis

- Technical Analytical Support
- Financial Analytical Support
- Strategic Planning
- Specialized Review Boards
- Army Science Board
- Board on Army S&T
- National Defense University
- Technology Maturity Assessments
- Army High Performance Computing Centers
- Science Advisors to Combatant Commanders

Partnerships

90% Industry
10% In-House

Manufacturing Technology

6.7

- Address manufacturing challenges for new technologies
- Facilitate affordable production that impacts Army procurement

People

Engineers, Industrial Designers, Craftsmen

- Chemical
- Civil
- Industrial
- Aerospace
- Structural
- Biomedical
- Mechanical
- Systems
- Process
- Plant management
- Materials

Partnerships

84% Industry
16% In-House

S&T Investment Strategy
Balanced Portfolio

Studies, Tech Planning Activities

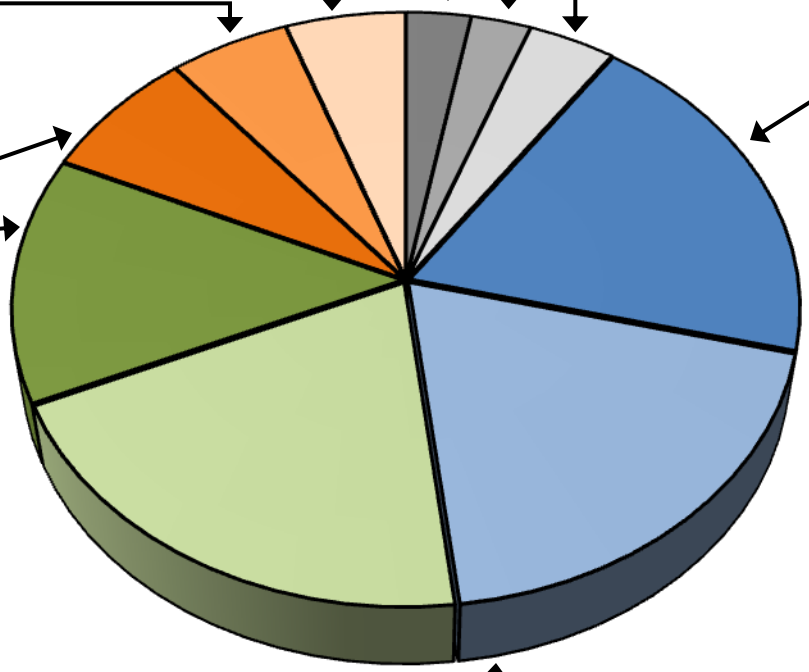
Competitive prototyping; Greater than TRL6

Manufacturing Technology

Long Term Exploration; Invention, discovery, future gazing, technology trends

TECDs—Near-term integrated capability demonstrations—predominately 6.3, may have some 6.2

Long-term Game-Changing (Disruptive) Technology



Long-term Enabling Technology Development—Innovation, invention, technology exploitation to create sub-system opportunities

6.7
6.5
6.4
6.3
6.2
6.1

Mid-term—Innovation*, maturation, technology demonstration; reducing technological risk; predominately supporting planned Programs of Record

* Includes Rapid Innovation Funding

MAINTAINING A LEADING EDGE IN TECHNOLOGY

Sources Informing S&T (6.2 & 6.3) Investment Decisions for 2014-2028

Commercial

Other Services

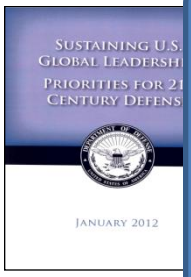
International/Allies

NGIC

Army Capstone Concept

JCIDS

DoD Priorities

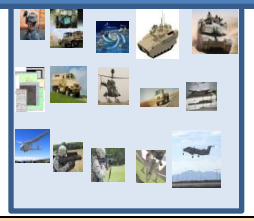


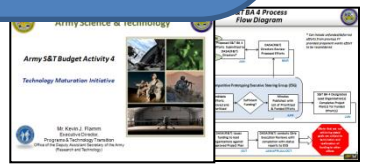
"…recalibrate its [U.S.'] and make selective addi investments in:"

- Counter Terrorism & Irregu Warfare
- Deter & Defeat Aggression
- Project Power Despite Anti-access/Area Denial Challenges
- Counter Weapons of Mass Destruction
- Operate Effectively in Cyber & Space
- Maintain a Safe, Secure & Effective Nuclear Deterrent
- Defend Homeland & Provide Support to Civil Authorities
- Provide Stabilizing Presence
- Conduct Stability & Counterinsurgency Operations
- Conduct Humanitarian, Disaster Relief, & Other Operations

in:

- Mission Command
- Intelligence
- Movement and Maneuver
- Fires
- Protection
- Sustainment
- Training and Leader Development
- Institutional Army
- Human Dimension





BA4 Tech Maturation

Wargaming Exercises

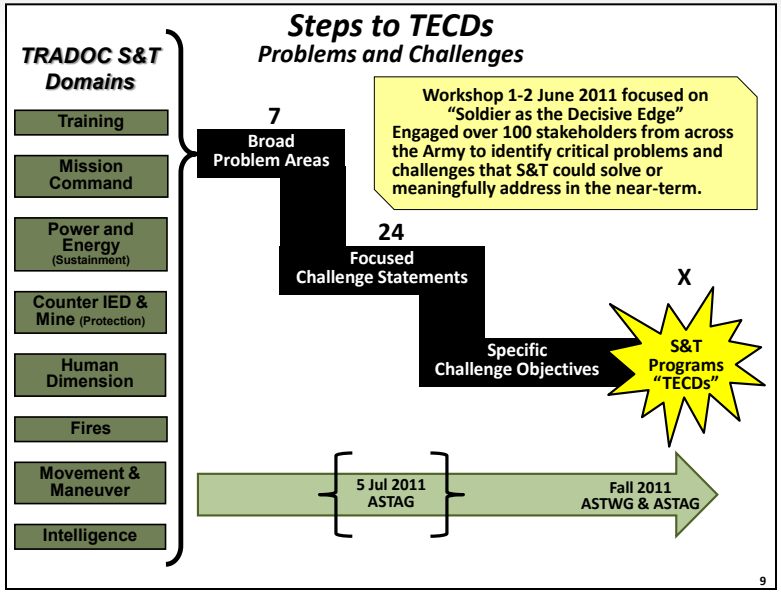
"The Squad is the foundation of the decisive force; it is the cornerstone of all units."

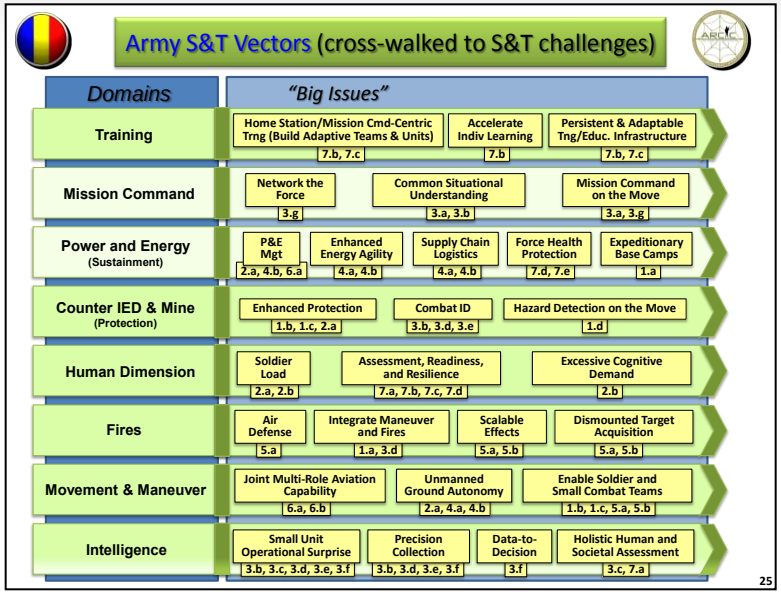
(Jan 25 2012 - CSA remarks at AUSA ILW Breakfast)

Three things S&T must invest in:
1) What we do that no one else does (maintaining core competencies)
2) What we do to advance capabilities
3) What "big bets" that others invest in so we can counter

MAINTAINING A LEADING EDGE IN TECHNOLOGY

Generating Near Term S&T Priorities
7 Problems and 24 Challenges?





Big Army Problems that S&T Must Help Solve
Current Focus: "Soldier as the Decisive Edge"

1. There is insufficient **FORCE PROTECTION** to ensure highest degree of survivability across the spectrum of operations.
2. Soldiers in Small Units (squads/fire teams/crews) are **OVERBURDENED** (physically and cognitively); this degrades performance and may result in immediate, as well as, long term consequences.
3. U.S. Army squads are too often **SURPRISED** in tactical situations. Soldiers in Small Units lack sufficient timely **MISSION COMMAND & TACTICAL INTELLIGENCE** to understand where their assets are, who and where the enemy is, who and where non-combatants are and to document and communicate this information to each other and higher echelons.
4. We spend too much time and money on **STORING, TRANSPORTING, DISTRIBUTING and WASTE HANDLING** of consumables (water, fuel, power, ammo and food) to field elements, creating exposure risks and opportunities for operational disruption.
5. Soldiers in Small Units have limited capability to integrate maneuver and fires in all environments to create **TACTICAL OVERMATCH** necessary to achieve mission objectives.
6. Operational **MANEUVERABILITY** (dismounted & mounted) is difficult to achieve in complex, austere, and harsh terrains and at high OPTEMPO.
7. We do not understand **WHAT MAKES THE HUMAN TICK** in a way that can lead to assured ability to perform operational, high OPTEMPO missions effectively and without secondary negative effects.

Problems listed in no particular order – validated by Senior Army Leadership

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24 Army S&T Challenges

	Challenge #	Challenge Title
Top 5	1b	Force Protection – Soldier & Small Unit
	1c	Force Protection – Occupant Centric Platform
	2a	Overburdened – Physical Burden
	3a	Surprise/Tactical Intelligence – Mission Command
	7d	Human – Medical Assessment & Treatment
Next 5	1a	Force Protection – Basing
	7b	Human – Individual Training to Tactical Tasks
	3b	Surprise/Tactical Intelligence – Actionable Intelligence
	4a	Sustainability/Logistics – Basing
	4b	Sustainability/Logistics – Transport, Distribute & Dispose
Remaining 14	1d	Force Protection – On the Move (Ground)
	2b	Overburdened – Cognitive Burden
	3c	Surprise/Tactical Intelligence – Cultural / Linguistic
	3d	Surprise/Tactical Intelligence – Organic Combat ID
	3e	Surprise/Tactical Intelligence – Overwatch Persistent Surveillance
	3f	Surprise/Tactical Intelligence – METT-TC Data/Information/Knowledge
	3g	Surprise/Tactical Intelligence – Network
	5a	Tactical Overmatch – Deliver Decisive Effects
	5b	Tactical Overmatch – Targeting/Hand-off
	6a	Maneuverability – On the Move (Air)
	6b	Maneuverability – Degraded Visual Environment (brown-out)
	7a	Human – Strength-based Soldier Characteristic Assessments & Readiness
	7c	Human – Collective Training for Tactical Operations
	7e	Human – Trauma Management

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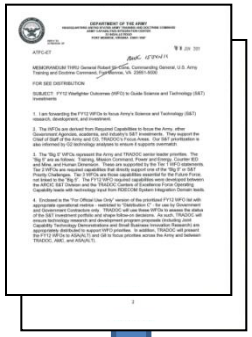
Characteristics of Technology Enabled Capabilities Demonstrations (TECD)

Warfighter Outcomes



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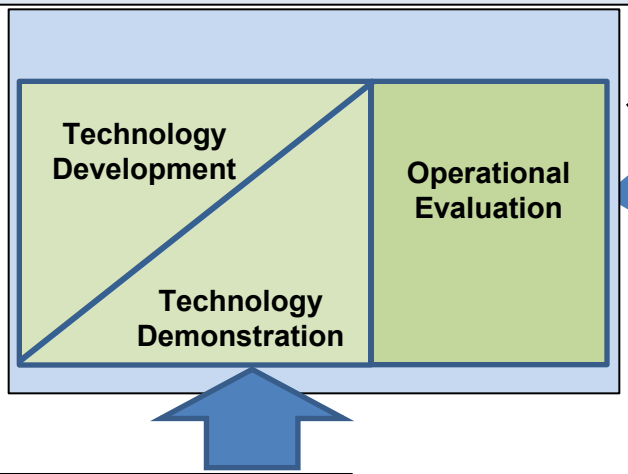
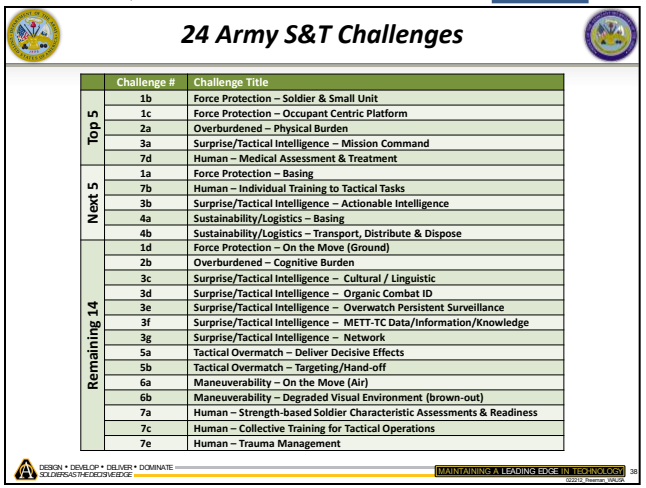


Field Limited Capability → Responsible PEO/PM Or Other mechanism

Continue Development → Acquisition PoR

Terminate → STOP

Army's Capability Portfolios



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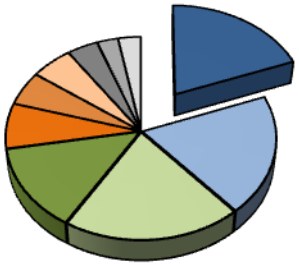
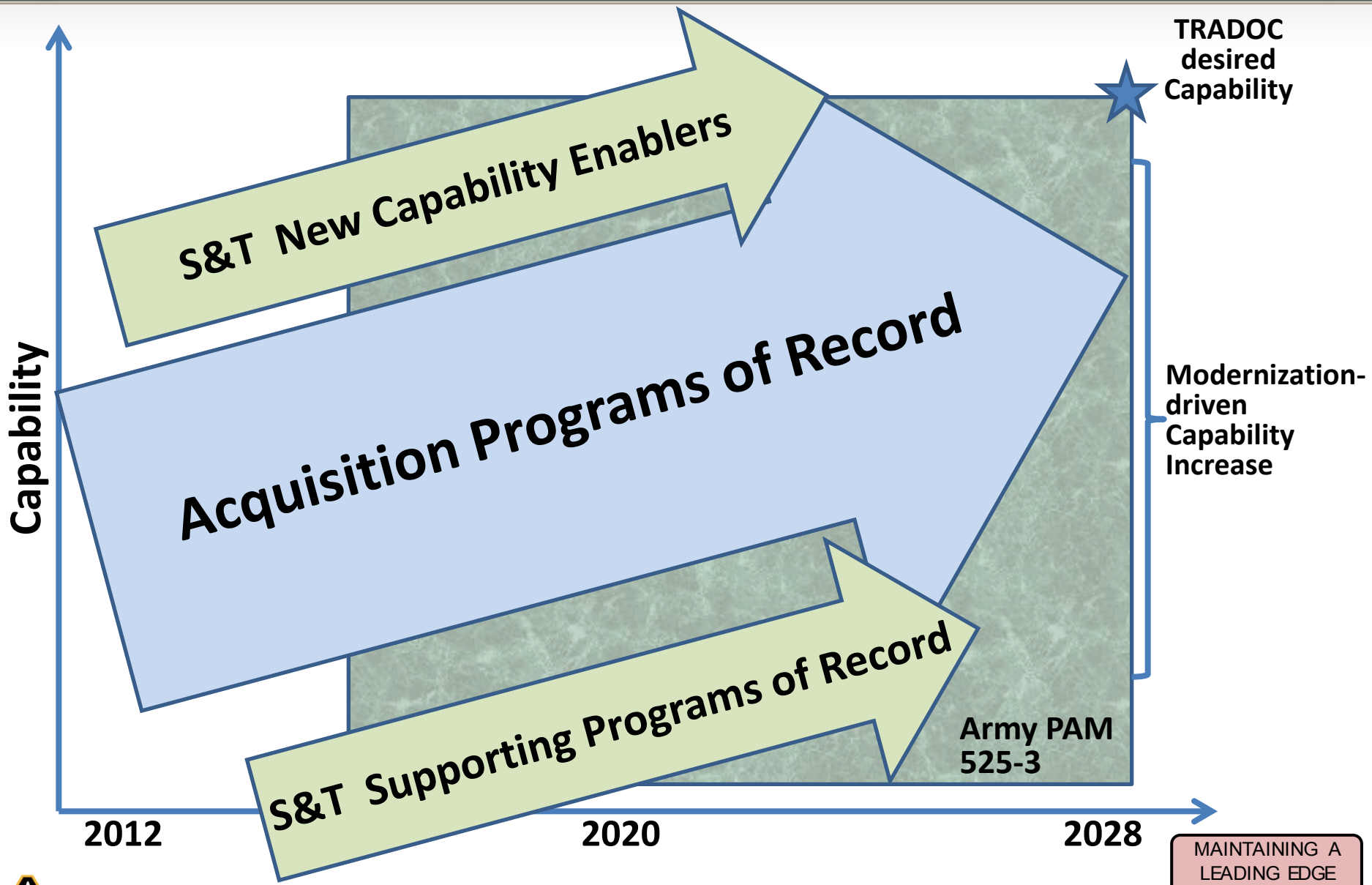
- Integrated programs across all S&T
- Integrated solutions/multiple systems
- Output is a full capability
- High-level oversight, including TRADOC involvement
- Current status – 9 TECDs approved against Top 10



Goal: ~50% Army S&T BA3 Invested in these programs

Current Army Modernization Path



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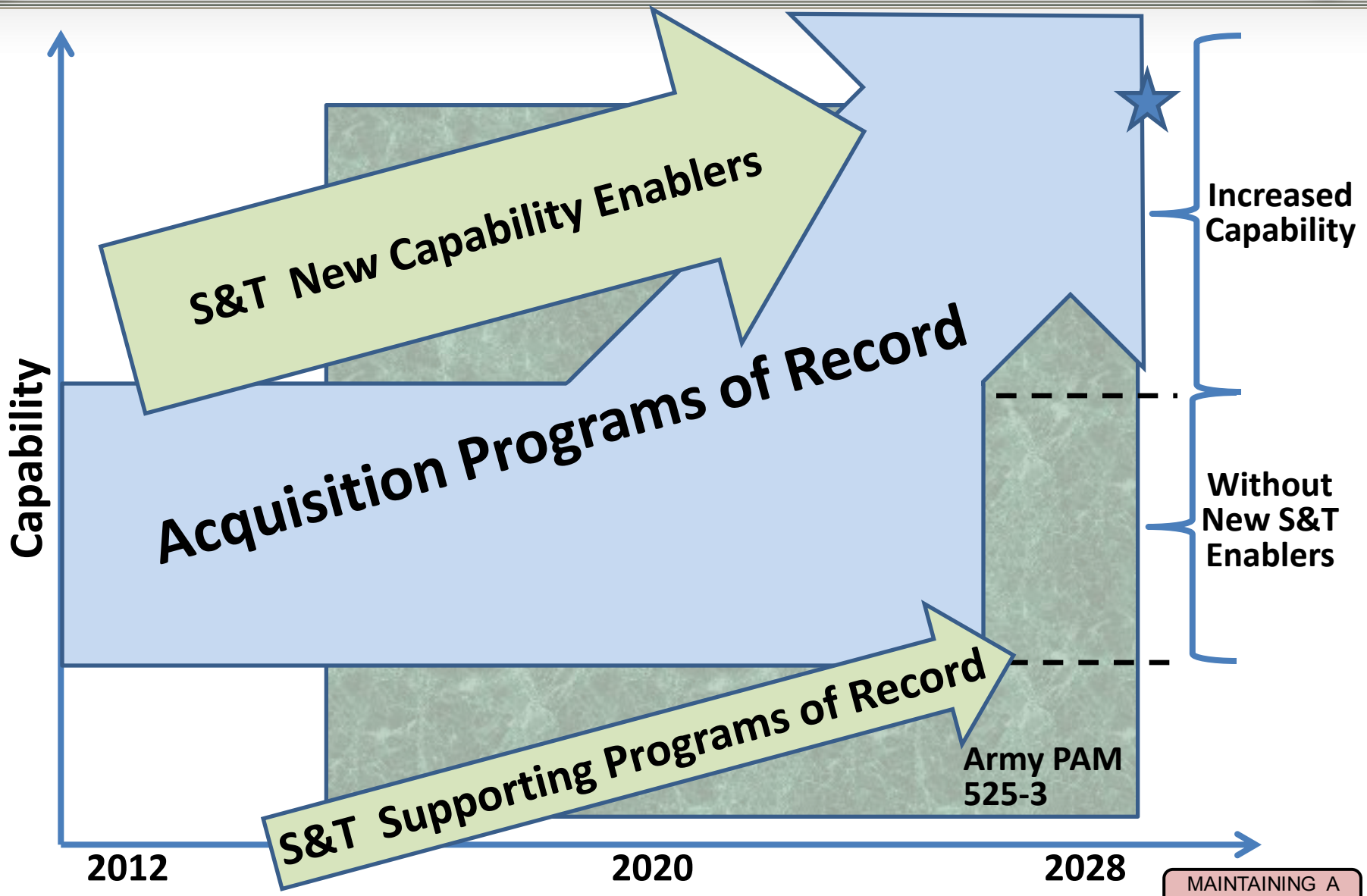
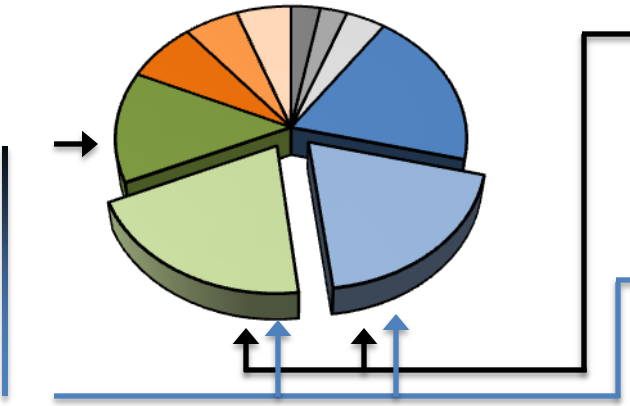
The Rest of the Story
Recovered Acquisition Budget

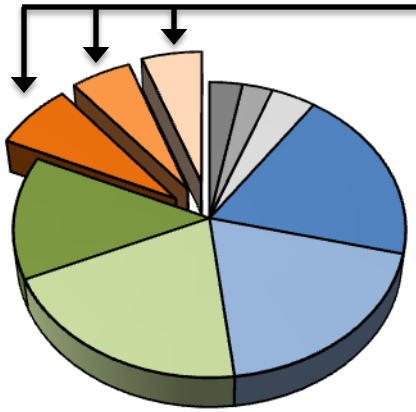


MAINTAINING A LEADING EDGE IN TECHNOLOGY

Next Steps

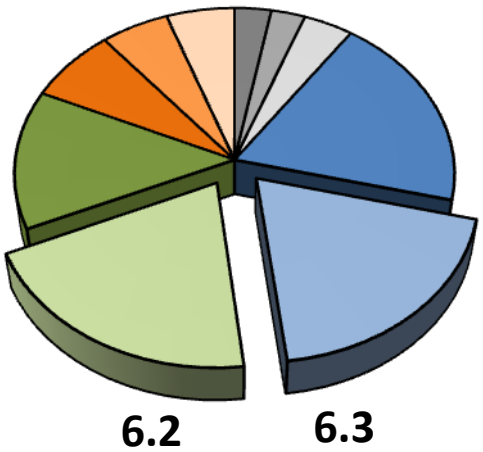


- Get PEO/PM Needs <u>and</u> define a set of programs to meet the highest priority ones
- Identify technologies that have high potential to "Bridge Gaps" or "Leap Ahead" – taking advantage of time when Acquisition programs are slowed down due to constrained budgets – <u>and</u> define a set of programs to meet the highest priority ones



- Define a set of priorities for Basic Research <u>and</u> identify challenge statements against which programs can be proposed and approved

How will we generate Mid-far term S&T Priorities? Programs to Bridge Gaps or Leap Ahead



- **Generate ideas for potential leap-ahead, gap filling, and/or disruptive technologies that lead to new or improved Army capabilities**

  <u>Completed Actions</u>:

  - ✓ **Drafted and populated initial technology matrix**
  - ✓ **Conducted brainstorming session with SAAL-ZT**
  - ✓ **Structured information to evaluate against criteria**

- **Obtain support from stakeholders and leadership in validating needs and priorities**
- **Develop high promise moderate risk programs grounded by knowledge and information gained from the understanding of Army needs and pervasive Army problems and technology opportunities**
  - **Create stepping stones that solve particular technological challenges by capitalizing on knowledge, data and solution sets that may or may not involve hardware solutions**
  - **Seek the support of industry and academia in identifying potential technology solutions to high priority capability challenges.**
- **Execute and monitor status of these programs with the full participation of and in partnership with TRADOC and the Acquisition community in anticipation of potential transition.**

In Summary…

- **We are changing the Army S&T business model to be an enduring, sustainable, successful enterprise model**
- **We are aligning our strategic planning to the budget processes so that we are more efficient and able to achieve "top-down" S&T leadership investment focus**
- **We are identifying critical Army problems that we can solve in the near and mid-term, using the best talent and skills wherever they exist**
- **We are enhancing visibility of Army S&T priorities to provide partnering opportunities to jointly solve problems and enhance our Warfighter capabilities**

The better we understand our needs and priorities the better able our enterprise will be to give us capability solutions

Where can you help?

- **Many opportunities and programs available to partner**
  - **Industry**
    - **IR&D**
    - **Army's Rapid Innovation Fund**
    - **SBIR Program**
    - **CRADA's**
  - **Academia**
    - **Grants**

For More Information

Office of the Assistant Secretary of the Army
(Acquisition, Logistics and Technology)

Army Research & Technology

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Tactical Overmatch – Deliver Decisive Effects

5.a

Problem Statement: At both fixed and mobile sites, Small Units need improved capabilities to detect threats and respond rapidly with precision fires to deliver decisive effects

Challenge: Formulate a S&T program for a system of systems including organic sensors and shooters that will enable the Army to increase the hemispherical protection for Soldiers against dismounted threats and incoming munitions. Program should address capabilities for static and mobile operations

Challenge Boundary Conditions:

Who: Soldiers at fixed and mobile sites in current and future hostile environments

What: Provide an organic capability for hemispherical protection from dismounted threats and incoming fire.

How: Comparing current and future threat detection and targeting capabilities; measure time required to reach operational readiness and required manpower during setup

Objectives:

Near term (FY17): For fixed sites, provide sense/warn and respond capability that automatically provides precise target locations to allow suppression of dismounted threats with precision . Provide the capability to detect and respond to indirect fire weapons.

Tactical Overmatch – Targeting/Hand-off

5.b

Problem Statement: Small Units require improved lightweight, day/night target acquisition capability to facilitate precision fires, intra-squad fires, call for fires, hand-off of targets to other assets and ability to conduct battle damage assessments.

Challenge: Formulate a S&T program to provide small dismounted units with the tools and training they need to detect, identify, and precisely locate targets without significant Size, Weight, Power or Cost (SWaP/Cost), number of devices, or the need for additional operators.

Challenge Boundary Conditions:

Who: Small Unit in irregular or conventional warfare,

What: Accurate, low SWaP/Cost targeting and hand-off capability

How: Measure impact on collateral damage, target location accuracy, unit lethality, speed/ accuracy, and probability of first shot hit target handoff measured against non-organic fires success for irregular warfare operations (2011 baseline).

Objectives:

Near term (FY17): In 2 years, provide faster*, more reliable/accurate target handoff between mounted and dismounted and intra-squad elements day and night. Provide significant increase in first hit probability at extended range.

Army Science & Technology

Providing Soldiers Technology Enabled Capabilities

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